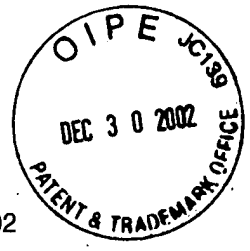
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
B for th Board f Patent Appeals and Int rf r nces

AF/2828



In re Patent Application of
ALLENSON et al
Serial No. 09/445,991
Filed: December 17, 1999

Atty. Dkt. 124-749
C#/M#
Group Art Unit: 2828
Examiner: G. Inzirillo
Date: December 30, 2002

RECEIVED
JAN -3 2003
TECHNOLOGY CENTER 2800

Title: A LIGHT EMITTING DEVICE AND TRANSISTOR

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

☒ **Correspondence Address Indication Form Attached.**

☐	**NOTICE OF APPEAL** Applicant hereby appeals to the Board of Appeals from the decision dated _____ of the Examiner twice/finally rejecting claims _____ ($ 320.00)	$ 0.00
☒	An appeal **BRIEF** is attached in triplicate in the pending appeal of the above-identified application ($ 320.00)	$ 320.00
☐	An **ORAL HEARING** is requested under Rule 194 ($280.00) (due within two months after Examiner's Answer)	$ 0.00
☐	Credit for fees paid in prior appeal without decision on merits	-$ (0.00)
☐	A reply brief is attached in triplicate under Rule 193(b)	**(no fee)**
☐	Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s) (**$110.00/1 month**; $400.00/2 months; **$920.00/3 months**; $1440.00/4 months)	$ 0.00
	SUBTOTAL	$ 320.00
☐	Applicant claims "Small entity" status; enter ½ of subtotal and subtract ☐ "Small entity" statement attached.	-$(0.00)
	SUBTOTAL	$ 320.00
	Less month extension previously paid on	-$(0.00)
	TOTAL FEE ENCLOSED	$ 320.00

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

1100 North Glebe Road, 8th Floor
Arlington, Virginia 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100
SCS:kmm

NIXON & VANDERHYE P.C.
By Atty: Stanley C. Spooner, Reg. No. 27,393

Signature: _____

#8
Bell
H1-03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

ALLENSON et al

Serial No. **09/445,991**

Filed: **December 17, 1999**

For: **A LIGHT EMITTING DEVICE AND TRANSISTOR**

Atty. Ref.: **124-749**

Group: **2828**

Examiner: **G. Inzirillo**

* *

APPEAL BRIEF

On Appeal From Group Art Unit 2828

Stanley C. Spooner
NIXON & VANDERHYE P.C.
8th Floor, 1100 North Glebe Road
Arlington, Virginia 22201-4714
(703) 816-4028
Attorney for Appellant

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal is QinetiQ Limited, by virtue of the Assignment from The Secretary of State for Defence recorded February 20, 2002, at Reel 012831, Frame 0459, and an Assignment from the inventors to The Secretary of State for Defence recorded December 17, 1999, at Reel 10544, Frame 0141.

II. RELATED APPEALS AND INTERFERENCES

There are believed to be no related appeals or interferences with respect to the present application and appeal.

III. STATUS OF CLAIMS

Claims 1-17 stand rejected in the second non-final Official Action. The Examiner contends that claims 1-17 are obvious under 35 USC §103 in view of the cited prior art.

IV. STATUS OF AMENDMENTS

No further response has been submitted with respect to the second non-final Official Action in this application.

V. SUMMARY OF THE INVENTION

The present invention relates to a laser device which operates with enhanced quantum efficiency across a broad band of modulation frequencies.

Typically fiber optic links are utilized to prevent feedback between input and output circuits of high frequency devices. Typically in systems relating to fiber optic communications and optical distribution of radio frequency, microwave, mm-wave and digital signals in electronic systems such as phased array radars, a fiber optic link is utilized to insulate an input circuit from an output circuit in order to prevent feedback from the output circuit affecting the input circuit. Typically such fiber optic links operate at an upper frequency limit of around 10 GHz which is set by the response capability of the laser to the input signal.

Conventional fiber optic links cannot deliver signal gain unless either electronic or optical amplifiers are included in the signal path. Additionally, for use in fixed impedance environments such as microwave circuits, a relatively narrow band impedance transformation is needed to match the low impedance laser in order to minimize signal loss (it will be recalled that impedance mis-match between transmitter and antenna results in a substantial reflected power.

Appellants found that an extremely efficient light emitting device could be provided by utilizing at least two light emitters, in which each of the light emitting devices had its own optical waveguide, impedance and quantum efficiency. Appellants found that by connecting the light emitters in series, the input impedance of the device is equal to the sum of the impedances of the light emitting means, and thus impedance could be matched, thereby preventing the adverse

consequences of reflected power. Moreover, it was also found that the quantum efficiency of the overall device is substantially equal to the sum of the quantum efficiencies of the individual light emitting means which were arranged optically so that the light emitting means do not share a common optical waveguide.

In view of the above discovery, the device has been successfully used in an isolation system for converting an electrical signal into an optical signal and then outputting an output electrical signal. Applications also include use as an optical repeater and also with respect to the division of an RF signal, into a number a fiber optic channels.

In view of the above, the present light emitting device is characterized by at least to light emitting means, each "**having a respective optical waveguide** and having an impedance and an individual quantum efficiency" with the at least two means "**electrically connected in series such that the input impedance of the light emitting device is substantially equal to the sum of the impedances of the light emitting means.**" Moreover, the quantum efficiency of the device is "**substantially equal to the sum of the quantum efficiencies of the light emitting means**" and specifically the "light emitting means do not share a common optical waveguide."

VI. ISSUES

Whether claims 1-8 are obvious under 35 USC §103 over Tucker (U.S. Patent 5,440,577) in view of Kushibe (U.S. Patent 4,928,285).

Whether claims 9-13 are obvious under 35 USC §103 over the Tucker/Kushibe combination, further in view of Ito (U.S. Patent 5,130,531).

Whether claims 14 and 15 are obvious under 35 USC §103 over the Tucker/Kushibe combination.

Whether claims 16 and 17 are obvious under 35 USC §103 as unpatentable over the Tucker/Kushibe combination, further in view of Hsu (U.S. Patent 5,317,440).

VII. GROUPING OF CLAIMS

The rejected claims stand or fall together as described in the argument portion of this Appeal Brief.

VIII. ARGUMENT

1. Discussion of the References

Tucker (U.S. Patent 5,440,577) teaches a semiconductor laser which has a plurality of lasing sections feeding a common optical waveguide. The Examiner admits that Tucker "fails to teach each light emitting element having a respective waveguide." (Official Action page 3, lines 3-4). In the copy of the Tucker reference forwarded by the Examiner, the various passages have been underlined

by the Examiner beginning at column 3, line 63, through column 4, line 10. A review of these passages indicates that Tucker has three sections, 10, 11 and 12, which are electrically isolated from each other by short sections of insulating material and that cathodes of some sections are cross-connected to anodes of other sections. These sections comprise individual lasers which all serve to pump the "passive waveguide 15" as shown in Figure 2 and as discussed at column 4, line 10 and line 19.

Tucker fails to teach the claim features of each light emitting means having its own optical waveguide and does not address the feature of the impedance and the individual quantum efficiency being accumulated.

Kushibe et al (U.S. Patent 4,928,285) teaches a single impurity-doped semiconductor linked to a waveguide. Kushibe teaches the benefit of single mode operation achieved by the addition of certain impurities into the laser structure.

Kushibe does not teach that a plurality of his devices could be interconnected so that they are electrically connected in series, or that with such connection the impedance of the overall device is the sum of the impedances of the individual light emitters, or that the quantum efficiency of the overall device is equal to the sum of the quantum efficiencies of the individual devices.

Ito et al (U.S. Patent 5,130,531) teaches a photodiode photodetector as discussed in the outstanding Official Action. However, there is no allegation that

Ito teaches any of the features of the present invention, such as at least two light emitting means where each of the light emitters has a separate optical waveguide, or that the light emitters are electrically connected in series such that the impedance and the quantum efficiency of the overall device is equal to the sums of the impedances and quantum efficiencies of the individual emitters.

Hsu (U.S. Patent 5,317,440) teaches a single wavelength bidirection optical fiber communication link for use in remotely controlling systems.

There is no disclosure of a light emitting device which comprises at least two light emitters with separate optical waveguides and instead relies upon a single emitter and a single waveguide. There is no disclosure, of course, that a plurality of light emitters could be connected in series so that the impedance of the device is equal to the sum of the individual impedances or that the quantum efficiency of the device is equal to the sum of the individual quantum efficiencies.

2. Discussion of the Rejections

Claims 1-8 stand rejected under 35 USC §103 as unpatentable over Tucker in view of Kushibe. To the extent the rejection is understood, the Examiner, while admitting that Tucker "fails to teach each light emitting element having a respective waveguide," suggests that this and the other claimed features are shown in the Kushibe reference. The Examiner fails to point out how or where there is any motivation for combining the Tucker and Kushibe references.

Claims 9-13 stand rejected under 35 USC §103 as unpatentable over the Tucker/Kushibe combination further in view of Ito. Again, to the extent it is understood, the Examiner cites Ito only for the teaching of a photodiode photodetector. The Examiner fails to mention any reason or motivation for combining the Tucker/Kushibe/Ito disclosures in the manner of appellants' claims.

Claims 14 and 15 stand rejected under 35 USC §103 as unpatentable over the Tucker/Kushibe combination. The Examiner suggests that the additional limitations of these claims would be obvious in view of the Tucker/Kushibe combination, but fails to provide any additional motivation or reason for combining elements disclosed in the disparate references.

Claims 16 and 17 stand rejected under 35 USC §103 as unpatentable ver the Tucker/Kushibe combination and further in view of Hsu. While the Examiner admits that the Tucker/Kushibe combination fails to teach a "repeater with a light emitting device, photodetector and amplifier," he suggests that this is taught in Hsu and that it would be obvious to combine Hsu with the Tucker/Kushibe combination. Again, to the extent it is understood, the Examiner does not appear to provide any reference to a motivation or a reason for combining the separate teaching of the individual patents.

3. The Errors in the Second Rejection

There are at least four significant errors in the second Rejection and they are summarized as follows:

(a) No prior art references teach a plurality of light emitters and a corresponding plurality of respective waveguides;

(b) No prior art device suggests linking the light emitters electrically in series such that the impedance and quantum efficiency of the overall device is equal to the sum of the impedance and quantum efficiencies of the individual devices;

(c) The Examiner has revealed no reason or motivation for combining the references; and

(d) The Tucker and Kushibe references teach away from the claimed invention.

(a) No prior art references teach a plurality of light emitters and a corresponding plurality of respective waveguides

The basic concept of the present invention is that the linking of two or more light emitting devices together provides improved quantum efficiency of the light emitting devices themselves, as well as greater impedance matching by the accumulation of the individual impedances. Thus, claim 1 in the present invention recites a plurality of light emitters and a plurality of respective waveguides. The

Kushibe reference teaches a single light emitter and a single waveguide and the desirability of achieving single mode operation. There is simply no discussion relating to a plurality of light emitters and a plurality of waveguides.

Tucker teaches a plurality light emitters, but as the Examiner admits, it "fails to teach each light emitting element having a respective waveguide." Tucker teaches that it is desirable to use the plurality of emitters to feed a single waveguide. Neither Ito nor Hsu teach a plurality of emitters or a plurality of waveguides.

Accordingly, the primary focus of claim 1, from which all other claims ultimately depend, requiring a plurality of light emitters feeding separate waveguides, is simply not present in any prior art reference. Without this combination being shown in a reference, it is impossible for the Examiner to show that the emitters are connected electrically in series or that the impedance and quantum efficiency of the overall device is substantially equal to the sum of the individual impedances and quantum efficiencies. Moreover, the Examiner cannot show or demonstrate that there is any suggestion in the prior art with respect to arranging the light emitters so that they do not share a common optical waveguide.

Thus, the subject matter of appellants' independent claim 1 is clearly not disclosed in the prior art cited by the Examiner and any further rejection under 35 USC §103 is respectfully traversed.

(b) No prior art device suggests linking the light emitters electrically in series such that the impedance and quantum efficiency of the overall device is equal to the sum of the impedance and quantum efficiencies of the individual devices

There is no allegation that the Kushibe, Ito or Hsu references teach any "serial linking of light emitters." Instead the Examiner relies upon the Tucker reference as allegedly teaching the features of a plurality of light emitters electrically connected in series, where the input impedance and quantum efficiency are essentially summed for the claimed light emitting device.

While the illustration in Figure 1 suggests that the individual light emitters are connected in series, they are not connected in series such that the individual impedances are accumulated such that their sum equals the impedance of the ultimate device. This is believed to be addressed at column 6, lines 39-44, which shows that for the Tucker device where each individual impedance is 5.5 ohms and there are three light emitters, the total device impedance would be 50 ohms. This is significantly higher than the appellants' claimed device impedance which is "substantially equal to **the sum of the impedances** of the light emitting means."

Thus, Tucker is not believed to teach the interconnection which provides that the device impedance is "substantially equal" to the sum of the individual impedances.

(c) The Examiner has revealed no reason or motivation for combining the references

The Court of Appeals for the Federal Circuit has held in the case of In re Rouffet, 47 USPQ2d 1453, 1457-8 (Fed. Cir. 1998) that

> "To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court **requires** the examiner to show a motivation to combine the references that create the case of obviousness. In other words, **the Examiner must show reasons** that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." (Emphasis added).

Neither the Tucker nor Kushibe reference contain any reason which would motivate one of ordinary skill in the art to combine portions of their respective teachings. Neither reference is directed towards the problem solved by appellants' claimed invention, i.e. impedance matching between input and output circuits and providing a plurality of beams of output radiation. Because neither Tucker nor Kushibe deal with the problem solved by the present invention, one of ordinary skill in the art would have no reason to pick and choose elements from the two references in an attempt to meet appellants' claim.

The Court of Appeals for the Federal Circuit has also confirmed that "[t]he PTO has the burden under §103 to establish a *prima facie* case of obviousness." *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). The Examiner has failed to meet his burden of establishing a "motivation to combine" or "reasons . . . [to] select the

elements" of the prior art references in the manner claimed. As a result, there is simply no basis for a rejection under 35 USC §103.

(d) The Tucker and Kushibe references teach away from the claimed invention

The Court of Appeals for the Federal Circuit has also confirmed that it is "error to find obviousness where references 'diverge from and teach away from the invention at hand'." *In re Fine*, at 1599.

The Kushibe reference teaches the provision of a single laser device connected to a single waveguide for light emitted from that laser. It is unrelated to any problem of impedance matching or improved quantum efficiency, etc. The Tucker patent teaches that a plurality of light emitters should be connected to a single common waveguide. There is no teaching or disclosure that the individual light emitters could be connected to separate waveguides, and indeed the benefit in Tucker is in connecting them to a single waveguide.

As a result, both Kushibe and Tucker teach away from a plurality of emitters, each having a respective waveguide, and the other interrelationships of appellants' independent claim 1. Accordingly, the combination of Tucker and Kushibe cannot render obvious appellants' claim 1 and claims dependent thereon, because each of Tucker and Kushibe would lead one of ordinary skill in the art away from appellants' invention, with Tucker suggesting multiple light emitters

feeding a single waveguide and Kushibe teaching only a single waveguide with a single light emitter. Accordingly, the rejection under 35 USC §103 must fail.

IX. CONCLUSION

As noted above, no reference suggests a plurality of emitters and a plurality of respective waveguides, let alone the electrical interconnection which permits impedances and quantum efficiencies to be cumulated. The Examiner has pointed to no reason or motivation for combining the Tucker and Kushibe references and apparently ignores the teachings in both Tucker and Kushibe which would lead one of ordinary skill in the art away from appellants' claimed combination.

Thus, and in view of the above, the rejection of claims 1-17 over the cited prior art is clearly in error and reversal thereof by this Honorable Board is respectfully requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____

Stanley C. Spooner
Reg. No. 27,393

SCS:kmm
Enclosures
Appendix A - Claims on Appeal

APPENDIX A

Claims on Appeal

1. A light emitting device (1), having an input impedance and a device quantum efficiency, for generating two or more beams of output radiation from an input current of electrons comprising;

at least two light emitting means (2a, 2b) for converting the input current of electrons into a beam of output radiation, each of the light emitting means having a respective optical waveguide and having an impedance and an individual quantum efficiency,

wherein the light emitting means (2a, 2b) (i) are electrically connected in series such that the input impedance of the light emitting device (1) is substantially equal to the sum of the impedances of the light emitting means (2a, 2b) and such that the quantum efficiency of the device (1) is substantially equal to the sum of the quantum efficiencies of the light emitting means and (ii) are arranged optically such that the light emitting means do not share a common optical waveguide.

2. The light emitting device (1) of Claim 1 wherein the light emitting means (2a, 2b) are electrically connected in any one of a parallel connection or in a series parallel connection.

3. The light emitting device of Claim 1, wherein the light emitting means (2a, 2b) are electrically connected such that the input impedance of the light emitting device is substantially equal to 50 Ω without additional circuitry or impedance matching elements.

4. The light emitting device of Claim 3, wherein each of the light emitting means (2a, 2b) have a modulation frequency limit and wherein the input impedance of the light emitting device (1) is substantially equal to 50 Ω across a frequency range substantially from DC to the modulation frequency limit of each of the light emitting means (2a, 2b).

5. The light emitting device (1) of Claim 1 wherein the light emitting means (2a, 2b) are p-n junctions (4, 5, 6).

6. The light emitting device (1) of Claim 5, wherein the p-n junctions (4, 5, 6) are laser diodes or light emitting diodes.

7. The light emitting device (1) of claim 6, wherein the laser diode devices may be any one of AlGaAs, AlGaInP, AlGaInAs or AlGaInAsP laser diode devices.

8. The light emitting device (1) of Claim 6, wherein the p-n junctions (4, 5, 6) each have an end face coated with a reflective coating.

9. An optically coupled transistor (18) for generating an output electrical signal comprising;

the light emitting device (1; 21) of Claim 1 for emitting at least two beams of output radiation (29) and

at least one photodetector (23) for detecting the beams of radiation output (29) from the light emitting device (1) and for converting the beams of output radiation (29) into an output electrical current (Ic),

wherein the light emitting device (1) and the at least one photodetector (23) are arranged such that there is no electrical feedback from the at least one photodetector (23) to the light emitting device (1).

10. The optically coupled transistor (18) of Claim 9 wherein the one or more photodetector is a photodiode device (23).

11. The optically coupled transistor (18) of Claim 9, comprising at least two photodetectors, wherein the photodetectors are connected in any one of a series connection, a parallel connection or a series parallel connection.

12. The optically coupled transistor (18) of Claim 9, comprising one or more optical fibres for transmitting the beams of output radiation (29) to the one or more photodetectors.

13. A fibre optic link comprising one or more optical fibres having an input endface and an output endface, and also comprising the light emitting device (1) of Claim 1,

wherein the light emitting device (1) is situated at the input endface of one or more optical fibres such that the beams of radiation output from the light emitting device are input to the one or more optical fibres.

14. A method for distributing an input signal into an output channel comprising the steps of;

(i) outputting two or more beams of radiation from the light emitting device (1) of Claim 1 comprising at least two light emitting means (2a, 2b; 21) and

(ii) inputting the two or more beams of output radiation into the output channel,

whereby the light emitting means (2a, 2b; 21) are connected such that the device quantum efficiency is greater than or equal to the individual quantum efficiency of one of the light emitting means.

15. A method for distributing an input signal into a plurality of output channels comprising the steps of;

(i) outputting two or more beams of radiation from the light emitting device (1) of Claim 1 comprising at least two light emitting means (2a, 2b; 21) and

(ii) inputting each of the two or more beams of output radiation into a different one of the output channels,

whereby the light emitting means (2a, 2b; 21) are connected such that the device quantum efficiency is greater than or equal to the individual quantum efficiency of one of the light emitting means.

16. An optical repeater for receiving an optical input signal and generating one or more optical output signals comprising;

a photodetector (23) for receiving the optical input signal and converting the optical input signal into an electrical signal and

the light emitting device (1) of Claim 1 for receiving the said electrical signal and outputting one or more optical signals.

17. The optical repeater of Claim 16 and also comprising amplification means for amplifying the electrical signal output from the photodetector (23).